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Amphipoda (Crustacea; Peracarida) from the Hydrothermal vent system of the Juan De Fuca Ridge, Escabana trough and Gorda ridge, Northeast Pacific. Part I. Lysianassidae and Sebidae

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Abstract

The amphipod fauna from hydrothermal vent habitats on the Juan de Fuca Ridge and from experimental wood deployments are examined. The material revealed, among others, a number of lysianassid species belonging to the genera, *Paronesimoides* Pirlot, 1933 and *Schisturella* Norman, 1900*,* and a species of the family Sebidae, belonging to the genus *Seba* Bate, 1862. The new species: *Paronesimoides voightae, Schisturella hansgeorgi,* and *Seba bathybia* are described. A key to *Paronesimoides* and *Schisturella* are given.

Key words: Amphipoda, Lysianassidea, Sebidae, *Paronesimoides, Schisturella, Seba*, hydrothermal vents, wood deployments, Juan de Fuca Ridge, Northeast Pacific

Introduction

This paper is the third in a series of taxonomic papers on Peracarids from chemically reduced habitats (hydrothermal vents, cold seeps, mud volcanoes). The first paper dealt with the Tanaidacea from the Juan de Fuca Ridge and surroundings, NE. Pacific (Larsen 2006), the second treated of the same taxon from the Lucky Strike Field, Midatlantic Ridge (Larsen *et al.* 2006). In this particular study, the amphipod fauna of the hydrothermal vents system in the Juan de Fuca Ridge is examined and the most predominant new taxa — *Paronesimoides voightae, Schisturella hansgeorgi,* and *Seba bathybia* — are described herein. All samples, except the Gorda Ridge sample, were taken at least 50 meters from the vents themselves.

The geological properties of the Juan de Fuca Ridge are described by Cox *et al.* (1964), and the overall biology is reviewed by Tunnicliffe *et al.* (1985), Van Dover *et al.* (1990), and Grassle & Petrecca (1994). A number of crustacean groups from this locality, have been treated, especially the Copepoda (Humes 1990; Heptner & Ivanenko 2002). Some amphipod taxa have also been described from the area (Shaw 1989; Martin *et al.* 1993) and the new material, from recovered wood samples supplement these studies.

Materials and methods

The material for this study was collected by the submersible *Alvin*, deployed from the RV *Atlantis* under the grant # DEB-0103690 to Dr. J. Voight. The material was supplied by the Field Museum of Natural History (FMNH) in Chicago, Illinois, US, which also host the types and most other material. Additional paratypes are deposited in Kitakyushu Museum of Natural and Human History.

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Experimental wood blocks were deployed on the sea floor in 2002. Each deployment consisted of a mesh diver's bag containing one 45.7 cm long piece of machine-cut, bark free, green 10.1 cm square Douglas fir (*Pseudotsuga* sp.) and an identical piece of oak (*Quercus* sp.) and secured by cable ties. Deployments were made in three habitat types: on heavy sediment cover, on and in the caldera of Axial Volcano. All experimental wood blocks were deployed from a Remotely Operated Vehicle (ROV). For detailed description of the sampling techniques employed see Larsen (2006). For station list and microhabitat details see Appendix 1 and 2.

Body length was measured by gently stretching the animal using two dissection needles. Habitus drawing were made on 'unstreched' specimens. Illustrations of body appendages were made from the outer lateral view. Dissections were made with chemically sharpened tungsten needles in glycerine. Appendages was stored in glycerine with clorazol black and sealed with nail-polish. The terminology for spines/setae follows Lowry & Stoddart 1993.

Systematics

Family Lysianassidae s. str. sensu Lowry & Stoddart 1997

Subfamily Tryphosinae Lowry & Stoddart, 1997

Genus *Paronesimoides* Pirlot, 1933

***Paronesimoides voightae* n. sp.**
(Figs. 1–3).

Material examined. Holotype, ovigerous female, 5.2 mm. (FMNH # 13756), Station code VOIJALV4046F, Dive 4046, near Wuzza Bare Mount, 3 September, 2004; 47°47.09' N 127°41.443' E. Depth 2656 m. Paratypes: 1 male, 4.1 mm. (KMNH IvR 700248), 1 male (dissected). 3 sex? 1.3 -2 mm, (FMNH # 12848). 1 ovigerous female, 1 male, 7 sex? 1.8–4.5 mm, (FMNH # 12895). 1 male 2.8 mm, 3 sex? 1.8–2.2 mm, (FMNH # 12899). 1 ovigerous female 4.9 mm, (dissected), 1 sex? 2.2 mm, (FMNH # 12906). 2 specimens, (FMNH # 12932). 2 males, 1 ovigerous female, 3 sex? 2.4–4.7 mm. 1 ovigerous female, (FMNH # 12987). 1 ovigerous female, 5.3 mm, (FMNH # 13022). 1 ovigerous female, 4.7 mm (dissected), 2 males 4.4–4.7 mm, (FMNH # 13027).

Diagnosis. Antenna 2 with large spiniform process on article 3. Coxa 1 posteroventral margin almost completely covered by coxa 2. Epimeron 3 with tiny posteroventral tooth. Maxilliped palp stout. Gnathopod 2 propodus rectangular. Telson distal margin smoothly rounded.

Etymology. Named after the expedition leader Dr. Janet R. Voight.

Description. Holotype, female 5.2 mm (only outward appearance of body); paratypes, female 4.7 and 4.9 mm (appendages).

Body (Fig. 1A). Rostrum lacking. Eyes absent. Lateral cephalic lobe prominent and acute, subantennular sinus concave. Body smooth, without posterior dorsal carinations**.** Epimeron 1 anterior margin tapering in posteroventral direction. Epimeron 2 subrectangular, corners rounded, anterior margin slightly concave. Epimeron 3 larger, trapezoid, with large posterior sinus and small posteroventral tooth. Urosomite 1 without depression.

Coxae (Figs. 1A, 3AB, 2C–G). Coxa 1 (Fig. 3A) posterior and distal margin smoothly curved but mostly hidden by coxa 2; posteroventral margin only visible in straightened specimens, with small distal indentation, w/d ratio 0.8. Coxa 2 (Fig. 3B) rectangular with small indentation at posteroventral corner, w/d ratio 0.5. Coxa 3 (Fig. 2C) of similar shape and size but without indentation, w/d ratio 0.6. Coxa 4 (Fig. 2D) only marginally

larger than coxae 2–3, with posterior margin strongly excavated, w/d ratio 0.8. Coxa 5 (Fig. 2E) larger than coxa 6–7, equilobate, w/d ratio 1.3.Coxa 6 (Fig. 2F) posterior lobe smoothly rounded and larger than anterior lobe, w/d ratio 0.9. Coxa 7 smallest, weakly trapetzoid, w/d ratio 1.1.

Antenna 1 (Fig. 1B). Shorter than head and pereonites 1–3. Peduncular article 1 about twice as long as article 2, with a slight distal tooth. Peduncular article 2 three times as long as article 3. Flagellum marginally longer than peduncle, with 13–15 articles. Accessory flagellum shorter than peduncle, 6-articulate; first article much shorter than first peduncle article. Second and third articles each less than half the length of first article, succeeding articles progressively shorter. Callynophore very weak.

Antenna 2 (Fig. 1C). About as long as antenna 1. Peduncular article 2 with prominent gland cone. Peduncular article 3 shorter than article 4, with long, lateral, distally denticulate process with several setae. Article 4 as long as article 5 but wider. Flagellum with 10–12 articles.

Mouthparts. *Epistome-labral complex* (Fig. 1D): upper lip almost completely fused with epistome, with setose slightly lobed apex. *Mandibles* (Fig. 1E, 1F) incisor (Fig. 1E1) well developed, with one denticle; spine row (Fig. 1E1, 1E2) with 3 bifurcate spiniform setae. Molar fairly broad, with dorsal projection, weakly triturative, setose. Palp 3-articulate, attached level with molar, article 1 very short, naked; article 2 1.25 times as long as article 3, with 6 posteroventral D2 setae; article 3 falciform, with 10 D3 setae, with 1 E3 seta, without A3-seta but with scattered setules. *Lacinia mobilis* in the shape of a blunt bifurcate peg-like spine, on left mandible only. *Lower lip* (Fig. 1G) outer lobes with distal curved process heavily setose along apical margin. Mandibular processes rather weak and tapering. *Maxilla 1* (Fig 1H)**:** inner plate slender, with 1 setulose and 1 or 2 small simple apical setae. Outer plate (Fig. 1H, 1H1) with spine or setal-teeth in 6/5 crown arrangement, STA–STD distally and medially cuspidate, ST1–4 almost smooth, ST5–6 distally and medially cuspidate, ST7 twice as large as other teeth, with almost straight cuspidate apex; several setules also present. Palp (Fig. 1H, H2) biarticulae, distal article 7 times as long as proximal article, flat and slightly widening, with 4 stout spiniform distal setae, 1 simple setae and setules. Proximal article very short. *Maxilla 2* (Fig. 1I) outer plate wider and with more setae than inner, apical setae only. Inner plate also with setae on inner margin. *Maxilliped* (Fig. 1J) inner plates reaching midlength of palp article 2, rectangular, covered with fine setules, with 4 short spiniform and 2 simple apical setae. Outer plates subovate, reaching distal margin of article 3, with outer setules and denticles along mediodistal margin and with row of subdistal robust setae. Palp articles not elongated and sparsely setose: article 1 as long as article 2, with 1 outer seta, article 2 about 1.33 times as long and twice as wide as article 3, with 1 outer and 5 inner setae, article 3 slightly longer than article 4, with 1 outer and 10 distal setae, article 4 and with scattered setae. Unguis small (less than one third of dactylus)

Gnathopod 1 (Figs. 2A, 2A1, 3A). Chelate. Basis with evenly spaced anterior setae and posterior ventral setae, more than 3 times as long as ischium. Ischium 1.2 times as long as merus, posterior margin with 3 setae. Merus with 1 posterior seta and setules, as long as carpus. Carpus, 0.4 times as long as propodus naked. Propodus rectangular and elongated, not wider than carpus, with sparse setation, posterior margin with 4 setae, palm without crenulations, distally with 1 lateral and 1 medial strong, curved spiniform setae. Dactylus with proximal and subdistal setae, very slightly exceeding palm.

Gnathopod 2 (Fig. 2B, 2B1, 2B2, 3B). Minutely chelate. Basis weakly setose, 1.7 times longer than ischium. Ischium with sparse setation, slightly shorter than carpus. Merus widening distally, more than half as long as carpus, with numerous setules along posterior margin. Carpus longer than ischium, medioventrally lobate, with pineapple cushion setae. Propodus mitten shaped, with pineapple cushion setae, margin densely covered with scale-like setae, with tuft of dorsodistal setae, posteroventral process guarding dactylus, palm extremely obtuse. Dactylus minute with proximal process and 2 subdistal setae.

Pereopods (Fig. 2C–G). Pereopod 3 (Figs 2C) and 4 (Fig. 2D) subequal and unremarkable not modified. Basis more or less naked, 4 times as long as ischium. Ischium more than half as long as propodus, posterior margin with setae. Merus 3 times as long as ischium, posterior margin with setae, strongly on pereopod 4. Carpus narrower than merus and ischium, more than half as long as propodus, with ventral setae. Propodus

FIGURE 1. *Paronesimoides voightae* n. sp. A, holotype habitus, lateral view (not straightened), female 5.2 mm (FMNH #13756). Scale bar 1 mm. – B–K paratypes, female, size 4.7 & 4.9 mm (FMNH # 13027 & 12906). B, antenna 1; C, antenna 2; C1, same different angle and specimen; D, upper lip, lateral view; D1 same, dorsal view; E, left mandible; E1, same, section of incisor and spine row (lateral view); E2 same, single spine of spine row; F, right mandible; G, lower lip; H, maxilla 1; H1 same, outer plate apical setae; H2, same, palp distal article; I, maxilla 2; J, maxilliped; J1 same, dactylus. Scale bar C1, H1, H2 and J1 0.1 mm, other scale bars 0.2 mm.

FIGURE 2. *Paronesimoides voightae* n. sp. Female paratypes, 4.7 & 4.9 mm (FMNH # 13027 & 12906). A, gnathopod 1; A1, same, palm and dactylus; B, gnathopod 2; B1, same, propodus; B2, same dactylus; C, pereopod 3; D, pereopod 4; E, pereopod 5; F, pereopod 6; G, pereopod 7; H, pleopod 1, setae not fully drawn for clarity; I, head and mouthparts. Scale bar A1, B1 0.2 mm, B2 0.1 mm, scale bar head = 0.2, other scale bars 0.5 mm.

marginally shorter than merus, posterior margin with 2 setae and distal tuft of small setae. Dactylus less than half as long as propodus, with 1 small dorsal seta. Pereopod 5 (Fig. 2E) basis moderately expanded and weakly setulated Ischium-propodus sparsely setulated and almost exclusively on anterior margin. Merus wider than following articles, with posteroventral extension. Carpus length subequal to merus. Propodus rectangular, 2.5 times as long as ischium Dactylus shorter than propodus, unguis not fused. Pereopod 6 (Fig. 2F) basis more elongated than on P5, weakly setulated. Ischium-propodus sparsely setulated mostly on anterior margin. Merus wider than following articles, with posteroventral extension. Carpus, propodus, and dactylus as

on P5. Pereopod 7 (Fig. 2G) basis strongly expanded and weakly setulated. Ischium-propodus sparsely setulated mostly on anterior margin. Merus-dactylus as on P5 & 6.

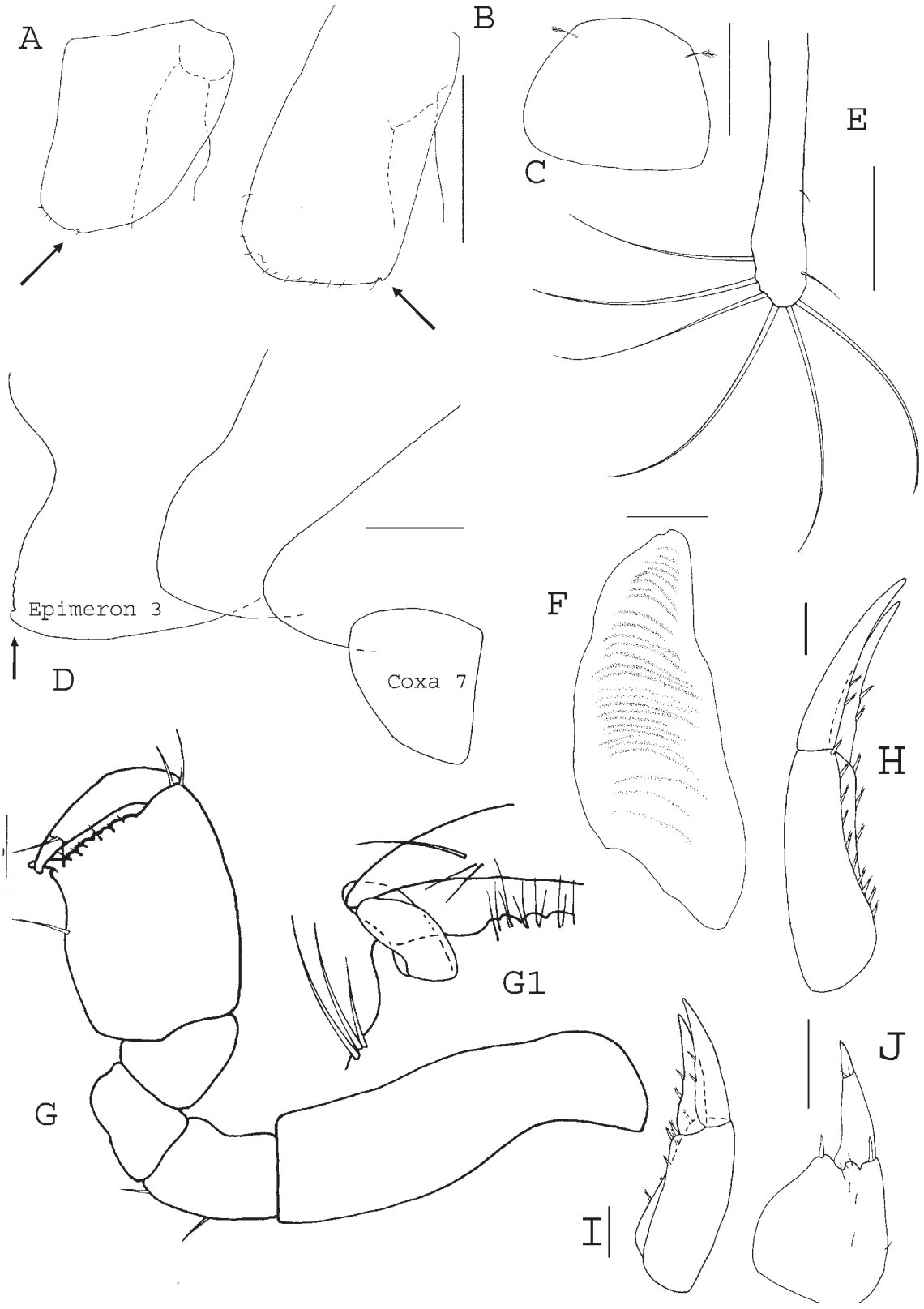

FIGURE 3. *Paronesimoides voightae* n. sp. Female paratype, 4.9 mm (FMNH #12906) and male paratype (FMNH # 12848) 4.2 mm. A, female gnathopod 1 coxa; B, female gnathopod 2 coxa; C, female telson; D, female coxa 7- epimeron 3; E, brood plate; F, female gill; G, gnathopod 1, male; G1, same, palm. H, uropod, female 1; I, uropod, female 2; J, uropod, female 3. Scale bar A, B, G = 0.5 mm. Scale bars H, I, J 0.1 mm., other scale bars = 0.2 mm.

Brood plates (Fig. 3E) elongated, with 5-7 large setae and 0-3 small setae.

Gills (Fig. 3F) Present on pereopods 2-7, elongated, pleated.

Pleopods (Fig 2H). Normal, peduncle with 2 serrated retinaculae, rami with 10–12 articles.

Uropods (Fig 2I–K). Uropod 1 (Fig. 2I) peduncle longer than rami, with 10 spiniform setae along medial and dorsolateral margin. Outer ramus marginally longer than inner ramus with few 2 spiniform setae along dorsal margin. Uropod 2 (Fig. 2J) shorter and stouter than uropod 1, peduncle naked, rami with 1 or 2 dorsal spiniform setae. Uropod 3 (Fig. 2K) peduncle shorter than outer ramus, distal margin with 1 spine, inner ramus reduced to a process, with 1 strong distal spiniform seta. Outer ramus biarticulate, first article twice as long as second article with terminal seta. Second article naked.

Telson (Fig. 3C). Subrectangular, entire, lateral margins slightly convex distal margin smoothly rounded, lateral margins with 1 distal submarginal setulated seta.

Male. *Gnathopod 1* (Fig. 3G, 3G1). Subchelate. Basis naked, more than 3 times as long as ischium. Ischium 1.2 times as long as merus, posterior margin with 2 setae. Merus naked, as long as carpus. Carpus trapezoid, 0.4 times as long as propodus naked. Propodus much longer and wider than in female, with sparse setation, posterior margin with 4 setae, palm nearly transverse, crenulated, with each notch bearing 2 setae, distally with 1 lateral and 1 medial strong, curved spiniform setae. Dactylus with proximal and subdistal setae, very slightly exceeding palm.

Remarks. Except for gnathopod 1 the male is essentially as female in body shape and appendages. *Paronesimoides voightae* differs from the only other species in the genus, *P. lignivorus* Pirlot, 1933 by having most of the posteroventral margin of coxa 1 covered by coxa 2, the rectangular shape of gnathopod 2 propodus and the rounded telson. The posteroventral process on article 3 of antenna 2 is not present in the Pirlot illustration (Pirlot 1933:28,pl 48C) and provides an easy visible differentiating character.

Ecological notes. This is a common species at the Juan de Fuca Ridge and as its sister species *P. lignivorus,* is only recorded from a wood fall habitat. It is fairly small, with all specimens < 5 mm.

Key to *Paronesimoides*

1. Antenna 2 article 3 with large triangular anterior directed process.....*P. voightae* n. sp.
   Antenna 2 article 3 without large triangular anterior directed process..... *P. lignivorus* Pirlot, 1933

Genus *Schisturella* Norman, 1900

Remarks. *Schisturella* has a complex synonymy and includes species which have previously been attributed to *Ambasiopsis* K.H. Barnard, 1931; *Anonyx* Krøyer, 1838; *Chironesimus* Sars, 1895; *Lakota* Holmes, 1908; *Pseudonesimus* Chevreux, 1926; *Tryphosa* Boeck, 1871.

***Schisturella hansgeorgi* n. sp.**
(Figs. 4–7).

Material examined. Holotype**,** male, 7.4 mm. (FMNH # 13757), Station code VOIJALV4045A, Dive 4045, Juan de Fuca Ridge, Endeavour Segment, 2 September 2004**,** 47°56.793' N 129°05.838' E. Depth 2213 m. – Paratypes: 1 male (KMNH IvR 700249) 3 males 5.1-6.3 mm, 2 males 5.4 & 5.2 mm (dissected), 2 sex? 4.2 & 6.2 mm, (in very bad condition) (FMNH # 12862).

Diagnosis. Eyes lacking. Epimeral plate 1 with small anteroventral tooth; epimeron 3 with posteroventral tooth. Urosome 1 with ventrodistal spine. Antenna 1 accessory flagellum first article as long as antenna1 article 4. Coxa 1 hidden under coxa 2. Coxa 1–2 with small tooth at the posteroventral corner. Gnathopod bases

with long setae. Gnathopod 2 carpus longer than propodus and rectangular. Epimeral plate 1 without anteroventral tooth. Uropod 2 inner ramus with long spiniform seta before the point of constriction. Telson cleft 0.65 x length; lobes rectangular, with processes at corners and medial spine.

Etymology. Named in honor of the Lysianassidae expert Dr. Hans Georg Andres.

Description. Holotype, male 7.4 mm (habitus only); paratype male, 6.4 mm, (all appendages).

Body (Fig. 4A). Laterally compressed. Eyes absent. Lateral cephalic lobe prominent, subacute. Body smooth. Epimeral plates 1-2 subrectangular, corners rounded, anterior margin concave, posterior margin convex. Epimeron 1 with small anteroventral tooth. Epimeron 3 larger, with posteroventral tooth. Urosomite 1 with small anterodorsal depression and ventrodistal spine.

Coxae (Figs. 4A, 7A–D). Coxa 1 (Figs. 4A, 7A) hidden under coxa 2, almost square, with small anteriodistal notch, w/h ratio 1.1. Coxae 2–4 increasing in size and protruding in anterior direction. Coxa 2 (Fig. 7B) elongated, with small anteriodistal notch, w/h ratio 0.6. Coxa 3 (Fig. 4AQ) slightly longer than C2, w/h ratio 0.5. Coxa 4 (Fig. 6D), posteroventral lobe broad, blunt, posterior margin with strong excavation, w/h ratio 0.8. Coxa 5 (Fig. 4A, 7C) weakly equilobate, w/h ratio 1.1. Coxa 6 (Figs. 4A, 7D) square. Coxa 7 (Fig.) w/h ratio 1.2.

Antenna 1 (Fig. 4B). Longer than head and pereonites 1–3 combined. Peduncular article 1 shorter than first article of accessory flagellum. Peduncular article 2 and 3 subequal. Flagellum longer than peduncle, with 13–15 articles, without calceoli. Callynophore well developed. First article of accessory flagellum as long as flagellum article 1. Accessory flagellum 4-articulate, marginally longer than peduncle.

Antenna 2 (Fig. 4C). 1.5 times as long as antenna 1. Peduncular article 1 fused to the head. Peduncular article 2 gland cone with blunt apex. Peduncular article 3 longer than article 2, with acute processes on both margins. Peduncular article 4 subequal to article 5, both lined anteromedially with brush setae. Flagellum with more than 40 articles without calceoli.

Mouthparts. *Epistome-labral complex* (Fig. 5A): upper lip with complicated lobation, pointed with large blunt process near separation with epistome, separated from the epistome by deep sinus, setose. *Mandibles* (Fig. 5B-C) incisor well developed, triangular smooth; spine row with 3 spiniform setae. Molar fairly broad, triturative. Palp attached level with molar, 3-articulate, article 1 short and naked, article 2 about 4 times as long as article 1, with 11 submarginal posteroventral D2 setae. Article 3 half as long as article 2 but wider, with 14 D3 setae, without E3 and A3-seta. Left mandible *lacinia mobilis* triangular and partly fused with incisor. *Lower lip* (Fig. 4D) outer lobes with prominent anterior setulation and very weak posterior setulation. *Maxilla 1* (Fig 5D) inner plate slender, with 2 bipinnate apical setae, outer plate (Fig. 5D1) with spiniform setae in 6/5 crown arrangement, STA–STD distally cuspidate, ST1–4 medially cuspidate, ST5–6 almost smooth, ST7 marginally cuspidate, widening distally. Palp (Fig. 5D2) biarticulate, distal article about 4 times as long as proximal article, with 11 stout spiniform and 1 simple distal setae. *Maxilla 2* (Fig. 5E) plates subequal, with apical and subapical simple and bipinnate setae, inner plate also with proximal inner setules *Maxilliped* (Fig. 5F) inner plates reaching end of palp article 1, rectangular with many bipinnate setae along inner margin transversing across to the outer corners, apical margin with 3 short denticles. Outer plates subovate, reaching end of palp article 2, apically with denticles, fully lined medially with denticles, outer margin setulated, with transverse row of small setulated setae. Palp articles not elongated; article 1 with 2 lateral and medial setae article 2 with 2 distal setae; article 3, with several medial and apical inner setae and isolated lateral apical setae**;** article 4 with 1 proximal and 3 distal setae.

Gnathopod 1 (Fig. 6A, A1). Subchelate. Basis slender, as long as merus, carpus and propodus combined, anterior margin strongly setose with tuft of ventrodistal setae. Ischium and merus of subequal size and with sparse ventrodistal setation. Carpus longer than propodus, ventrally lobate, with ventral setulation and isolated dorsodistal setae. Propodus rectangular, longer than ischium with row of ventral setae, tuft of dorsal setae at dactylus insertion and transverse row of setae. Palm transverse with small setae, palmar corner defined by one lateral and one medial strong distal spiniform setae. Dactylus with 1 outer seta.

FIGURE 4. *Schisturella hansgeorgi* n. sp. A, holotype, male habitus, lateral view (not straightened), 7.4 mm (FMNH # 13757), Scale bar 1 mm; B–D male paratype, 5.4 mm (FMNH #12862). B, antenna 1; C, antenna 2; D, lower lip; E, pleopod 1, setae not fully drawn for clarity. E1 peduncle retinaculae. Scale bar E1 = 0.1 mm, other scale bars = 0.5 mm.

Gnathopod 2 (Fig. 6B, B1). Minutely subchelate. Basis weakly setose, twice as long as ischium. Ischium longer than merus, with sparse ventrodistal setation. Merus widening distally, shorter than carpus, with dorsodistal setation. Carpus twisted in illustration, longer than merus, with small ventral lobe, with pineapple cushion, with turf of dorsodistal setae. Propodus (Fig. 6B1) mitten shaped, with pineapple cushion and scale-like

setae on both distal margins, with ventral and dorsodistal turf of pinnate setae. Palm shape is obtuse Dactylus minute with 1 dorsal seta and on ventral tooth.

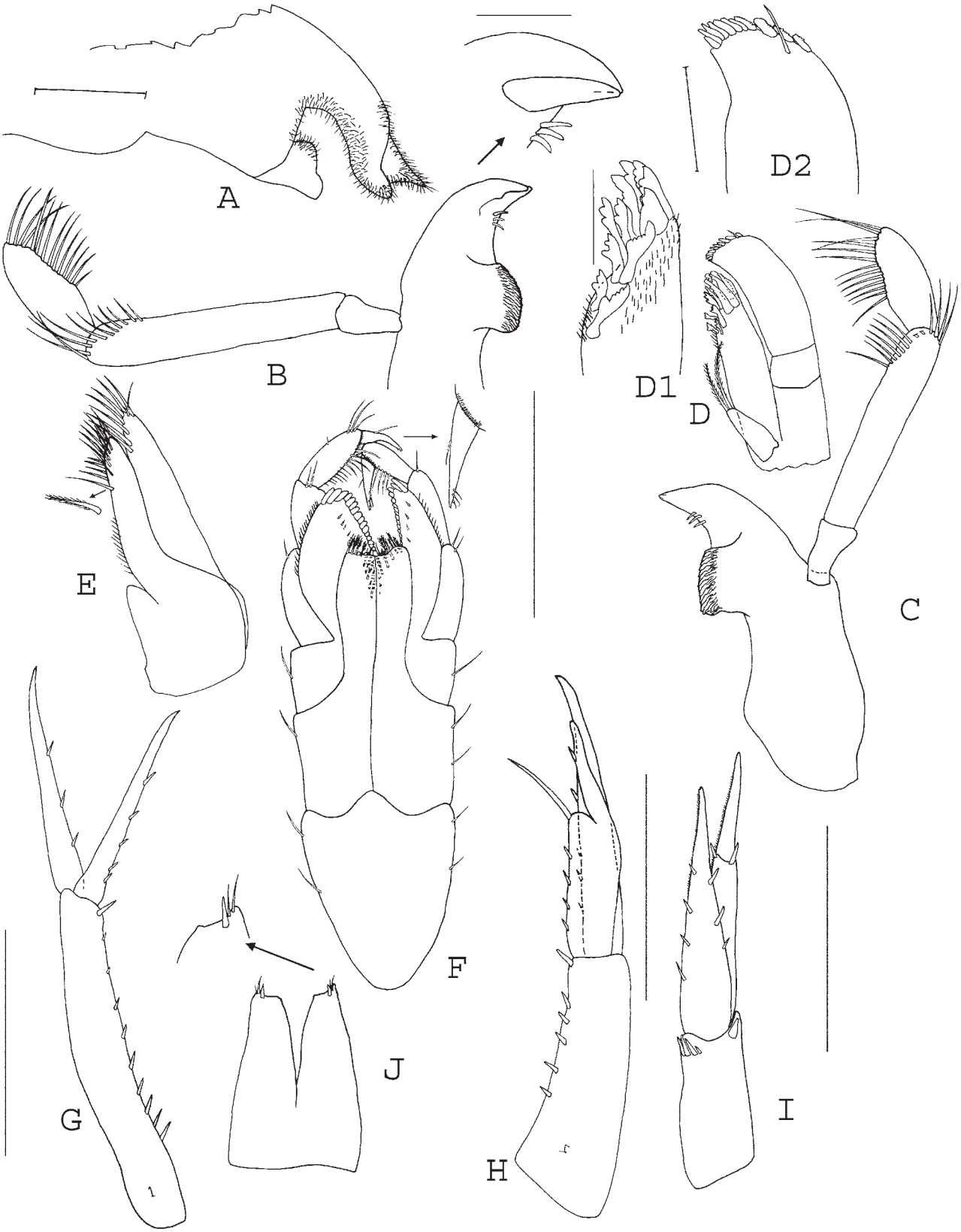

FIGURE 5. *Schisturella hansgeorgi* n. sp. Male paratype, 5.4 mm (FMNH #12862). A, upper lip, lateral view; B, left mandible; C, right mandible; D, maxilla 1; D1, outer plate apical setae; D2, distal palp article; E, maxilla 2; F, maxilliped; G uropod 1; H, uropod 2; I uropod 3; J, Telson. Scale bars, mouthparts 0.2 mm, details 0.1 mm, other scale bars: 0.5 mm.

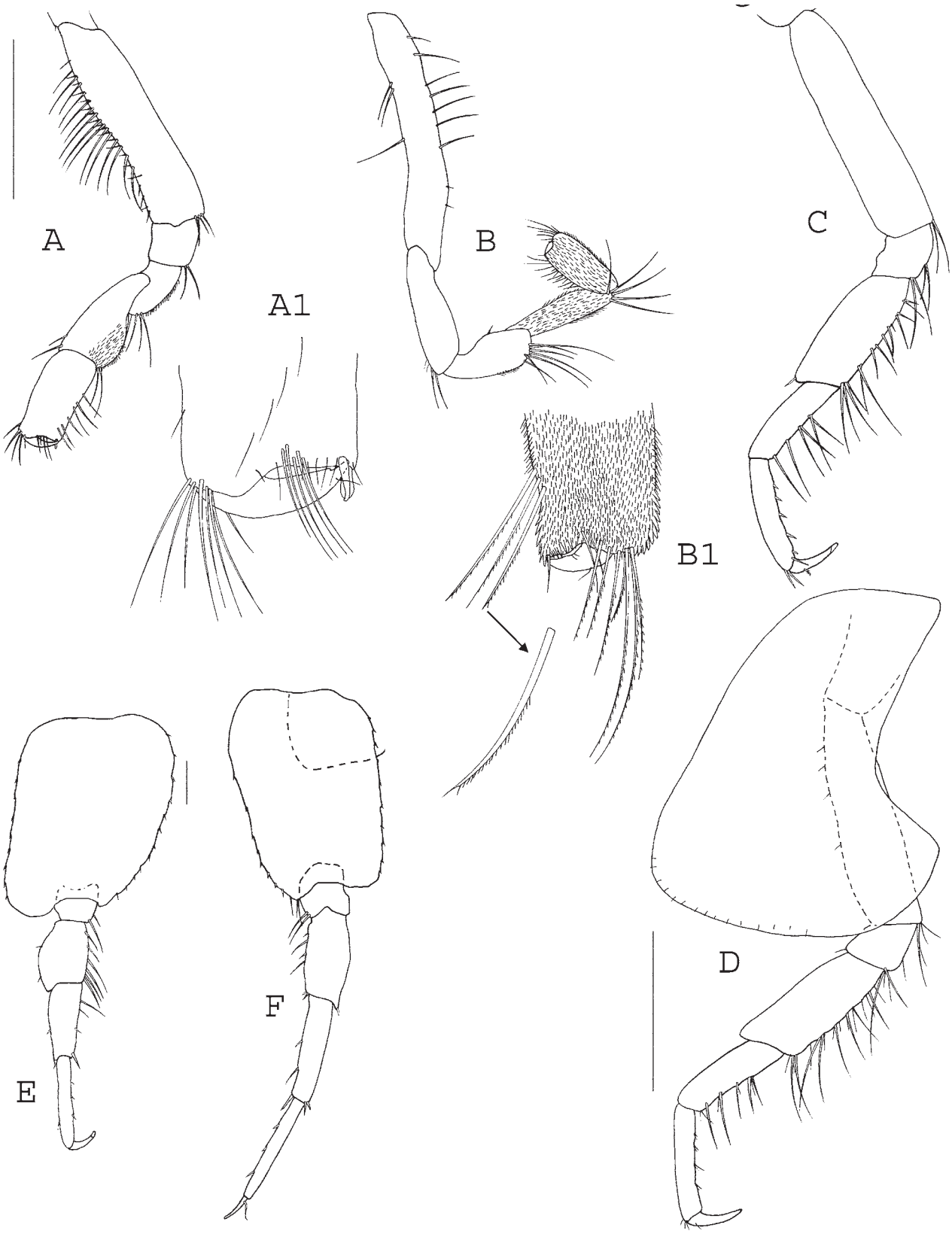

FIGURE 6. *Schisturella hansgeorgi* n. sp. Male paratype, 5.4 mm (FMNH #12862). A, gnathopod 1; A1, same distal end of propodus; B, gnathopod 2; B1, same, distal end of propodus; C, pereopod 3; D, pereopod 4; E, pereopod 5; F, pereopod 6. Scale bar G1 0.1 = mm, other scales bars = 0.5 mm.

Pereopods (Fig. 6C–F). Pereopod 3 (Fig. 6C) basis slightly shorter than ischium, merus and carpus combined, naked except for ventrodistal tuft of setae. Ischium half as long as carpus, with ventral setae. Merus nearly half as long as basis, with ventral setae. Carpus narrower than merus and ischium, with ventral setae. Propodus subequal to carpus, with shorter ventral spine-like setae and dorsodistal setae. Dactylus less than half as long as propodus, with 1 small bipinnate dorsal seta. Pereopod 4 (Fig. 6D) as pereopod 3. Pereopod 5 (Fig. 6E) basis expanded and weakly setose, posteroventral lobe of prominent. Ischium half as long as merus sparsely setose and almost exclusively on anterior margin. Merus wider than carpus, with slight dorsal extension, anterior margin setose. Carpus rectangular, anterior margin with sparse setation. Dactylus less than half as long as propodus, without setae. Pereopod 6 (Fig. 6F) merus-propodus more elongated than pereopod 5. Dactylus with 1 seta. Pereopod 7 missing or damaged on all specimens.

Brood plates. No females found.

Gills (Fig. 7G). Present on pereopods 2-7, large, pleated.

Pleopods (Fig. 4E). Peduncle with 2 retinaculae. First article of inner rami with bluntly bifurcated setae; first article of outer ramus 1.4 times as long as inner ramus, both rami with 14–16 articles.

Uropods (Fig. 5G–J). Uropod 1 (Fig. 5G) with spiniform setae on both peduncle and rami. Rami clearly shorter than peduncle, inner ramus marginally (about 10%) shorter than outer. Uropod 2 (Fig. 5H) shorter but stouter than uropod 1**,** peduncle and rami with spiniform setae. Outer ramus longer than peduncle and inner ramus. Inner ramus as long as peduncle, with deep constriction beyond insertion position of long spiniform seta. Uropod 3 (Fig. 5I) biramous. Peduncle shorter than rami, with several robust distal spiniform setae. Outer ramus biarticulate, proximal article 1.5 times as long as distal article, with spiniform setae and small spiniform setae on inner apical margin, with 1 large spiniform seta on both margins at articulation; distal article with small spiniform setae on inner margin. Inner ramus shorter than outer, with spiniform setae and small spiniform setae on inner apical margin,

Telson (Fig. 4A, 5J). Deeply cleft, 0.65 x length, extending beyond peduncle of uropod 3. Lobes truncate apically, with tiny process laterally and medially; apical margin line sloping medially, bearing one spiniform and two simple setae laterally.

Remarks. *Schisturella* is currently comprised of 12 recognized species (excluding the new one described below) plus 2 subspecies. This species can be separated from: *S. cocula* J.L. Barnard, 1966 by lack of eyes. From *S. dorotheae* (Hurley, 1963) by the long first article of the antennule accessory flagellum. From *S. pulchra* (Hansen, 1888) by the lack of eyes and presence of a long spiniform seta before the point of constriction on uropod 2 inner ramus. From *S. adversicola* (K.H. Barnard, 1925) by the lack of eyes and by the rectangular telson lobes. From *S. tracalero* (J.L. Barnard, 1966) by the square coxa 1. From *S. spinirama* Hendrycks & Conland, 2003 by the presence of an acute tooth on the posteroventral corner of epimeron 3. From *S. abyssi* (Chevreux, 1926) + subspecies *S. abyssi tasmanensis* J.L. Barnard, 1961 and *S. rotundata* (K.H. Barnard, 1925) by the acute tooth on the posteroventral corner of epimeral plate 3 and the large upper lip lobe extending from below the epistome. From *S. zopa* J.L. Barnard, 1966 by the gnathopod bases anterior margin with row of long setae and by the many spiniform setae on the uropods. From *S. robusta* (J.L. Barnard, 1961) + subspecies *S. robusta cedrosiana* J.L. Barnard, 1967 by the epimeron 3 tooth; and a more deeply cleft telson with apical armament of telson lobes. From *S. totorami* J.L Barnard, 1967 by the pointy upper lip; the smooth anteriodistal process on epimeron 1 and pointy tooth posteroventral on epimeron 3. From *S. grabensis* J.L. Barnard, 1967 by the small coxa 1 hidden under coxa 2; the pointy shape of the upper lip; the presence of anteriodistal process of epimeron 1; also the shape of the gnathopod 1 propodus is different, rectangular and with a straight distal edge in the new species, not transverse as in *S. grabensis*. Unfortunately none of the specimens of *S. hansgeorgi* display a full complement of appendages.

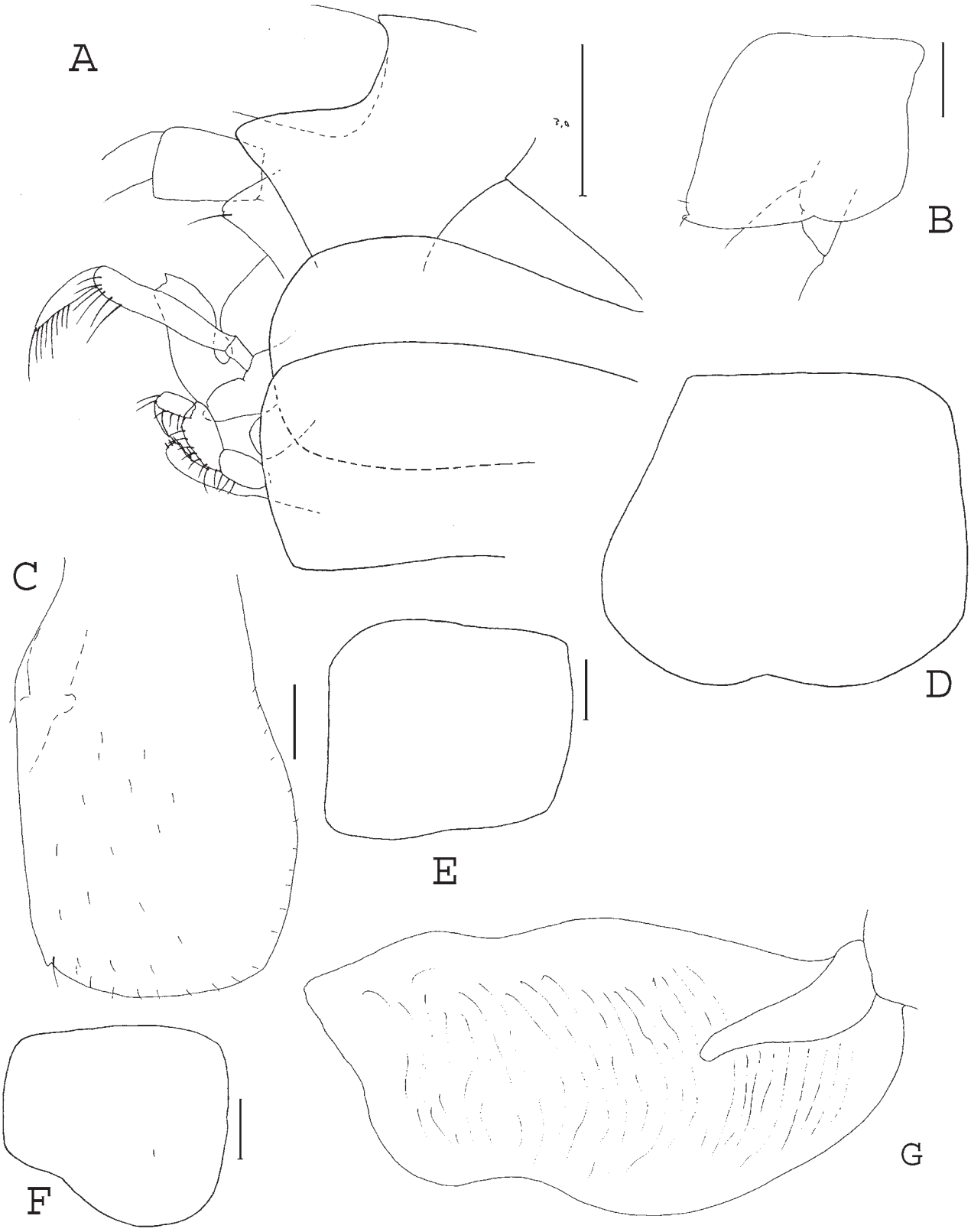

FIGURE 7. *Schisturella hansgeorgi* n. sp. Male paratype, 5.4 mm (FMNH #12862). A, head and mouthparts; B, gnathopod 1 coxa; C, gnathopod 2 coxa; D, pereopod 5 coxa; E, pereopod 6 coxa; F, pereopod 7 coxa; G, gills. Scale bars = 0.2 mm.

Key to the genus *Schistrurella*

1. With eyes 2
   Without eyes 4
2. Epimeron 3 without posteroventral tooth ..... *S. pulchra* (Hansen, 1888)
   Epimeron 3 with posteroventral tooth 3
3. Epinemon 2 posteroventral corner acute. Telson deeply cleft (more than two third) ..... *S. cocula* J.L. Barnard, 1966
   Epinemon 2 posteroventral corner smoothly rounded. Telson cleft just beyond midlength ..... *S. adversicola* (K.H. Barnard, 1925)
4. Epimeron 3 with posteroventral tooth 5
   Epimeron 3 without posteroventral tooth 9
5. Coxa 1 less than half as long as coxa 2 6
   Coxa 1 longer than half of coxa 2 13
6. Antenna 1 accessory flagellum first article much shorter than antenna 1 article 4. Epimeron 1 without anteriovental projection ..... *S. dorotheae* (Hurley, 1963)
   Antenna 1 accessory flagellum first article about as long as antenna 1 article 4. Epimeron 1 with anteriovental projection 7
7. Coxa 1 strongly trapezoid and anteriorly extended. Gnathopod 1 propodus distal margin oblique ..... *S. totorami* J.L. Barnard, 1967
   Coxa 1 strongly trapezoid and anteriorly extended. Gnathopod 1 propodus distal margin oblique 8
8. Gnathopod 1 and 2 bases anterior margin with row of long setae. Uropods 1 and 2 peduncle and rami with several spiniform setae. Uropod 3 rami with several spiniform setae ..... *S. hansgeorgi* n. sp.
   Gnathopod 1 and 2 bases anterior margin with 1 or no long setae. Uropods 1 and 2 peduncle and rami with 3 or less spiniform setae. Uropod 3 with only 1 spiniform seta ..... *S. zopa* J.L. Barnard, 1966
9. Epimeron 1 with anteriodistal tooth ..... *S. spinirama* Hendrycks & Conland, 2003
   Epimeron 1 without anteriodistal tooth 10
10. Upper lip with small anterior process nearly level with epistome ..... *S. abyssi* (Chevreux, 1926), *S. abyssi tasmanensis* J.L. Barnard, 1961
    Upper lip with large anterior process projecting beyond epistome 11
11. Coxa 1 semi extended anteriorventrally ..... *S. rotundata* (K.H. Barnard, 1925)
    Coxa 1 semi oval 12
12. Cephalic lobe blunt ..... *S. robusta* (J.L. Barnard, 1961)
    Cephalic lobe pointed ..... *S. robusta cedrosiana* J.L. Barnard, 1967
13. Coxa 1 reaching margin of coxa 2. Epimeron 2 posteroventral corner smoothly curved ..... *S. grabensis* J.L. Barnard, 1967
    Coxa 1 not reaching margin of coxa 2. Epimeron 2 posteroventral corner acute ..... *S. tracalero* (J.L. Barnard, 1966)

FAMILY Sebidae Walker, 1907

Genus *Seba* Bate, 1862

Remarks. The higher level systematics of this group is still debated and a number of different affiliations have been suggested (Schellenberg 1931; Karaman 1971; Bousfield 1979; Holman & Watling 1983; Shaw 1989), but phylogenetic resolution falls outside the scope of this study.

***Seba bathybia* n. sp.**
(Figs. 8–11).

Material examined. Holotype male, 2.8 mm (FMNH # 13758), Station code VOIJALV4046F, Dive 4046, near Wuzza Bare Mount, 3 September-2004 47°47.085'N 127°41.478'E. Depth 2656 m. Paratypes: 1 male, 2.1 mm, (KMNH IvR 700250). 1 male (dissected), 3.2 mm, 1 female, 3.3 mm (dissected), 1 female 3.5 mm (FMNH # 12771). 29 males3 females, 5 sex? 1.8–3.6 mm, (FMNH # 12883). 9 males, 3 females, 2 sex? 1.2-2.9 mm, (FMNH # 12906). 1 male 3.4 mm (dissected) 33 males, 9 females 12 sex? 1.3-3.6 mm (FMNH # 12987). 9 males, 3 females 2.0–3.5 mm, (FMNH # 12995). 41 males, 5 females, 8 sex?, 2.2–3.8 mm, (FMNH # 13009). 10 males 4 females, 2.8–3.4 mm, (FMNH # 12027). 1 male 2.2 mm, (FMNH # 13127). 1 female, 3.2 mm, (FMNH # 13194).

Diagnosis. Coxa 1 and 3 with small posteroventral notch. Coxa 2 with prominent tooth at posteroventral corner. Coxa 4 clearly largest, posterior margin deeply excavated. Mandibular palp article 3 almost as long as article 2, with blunt apex.

Etymology. Named after the deep collection site, the deepest of any *Seba* (*bathybia* from *Greek: bathys, bios* = 'deep living').

Description. Holotype, male 2.8 mm (only external body). Paratype, female, body length 2.4 mm (appendages).

Body (Fig. 8A). Smooth. Rostrum blunt. Eyes absent. Lateral cephalic lobe prominent. Epimeron without posteroventral spiniform processes. Epimeron 1-2 subrectangular, corners with small tooth, anterior margin straight, posterior margin weakly concave. Epimeron 3 larger, posteroventral corner smoothly rounded.

Coxae (Fig. 11A–G). Coxa 1 (Fig. 11A) shorter but wider than coxa 2, widest midlength, with 2 small distal teeth, w/d ratio 1.4. Coxa 2–4 size increasing, coxa 2 (Fig. 11B) elongated, widest proximally, with large posteroventral tooth at corner, w/d ratio 0.4. Coxa 3 (Fig. 11C) widest distally, with small posteroventral notch, w/d ratio 0.5. Coxa 4 (Fig. 11D) largest, posterior margin deeply excavated, corner acute, w/d ratio 0.7. Coxa 5 (Fig. 11E) bilobed, w/d ratio 1.4. Coxa 6 (Fig. 11F) weakly bilobed, posterior lobe much larger, w/d ratio 0.9. Coxa 7 (Fig. 11G) oval, with tiny distal notch, w/d ratio 0.8.

Antenna 1 (Fig. 8B, 8B1). Longer than head and pereonites 1–3, length subequal to antenna 2. Peduncular article 1 0.9 times as long as article 2. Peduncular article 2 twice as long as article 3. Flagellum shorter than peduncle, with 4–5 progressively shorter articles, distally with setae. Accessory flagellum (Fig. 8B1) with 2 articles, the proximal about 7 times longer than the distal. Peduncular article 3 & 4 with aesthetascs.

Antenna 2 (Fig. 8C). As long as antenna 1. Peduncular article 1 with head. Peduncular article 2 short, gland cone feeble. Peduncular article 3 square, one third as long as article 4. Peduncular article 4 1.33 times as long as article 5. Peduncular article 5 twice as long as article 3. Flagellum with 2–3 articles.

Mouthparts. *Epistome-labral complex* (Fig. 8D, 8D1): epistome separate, wider than upper lip, naked; upper lip, weakly setose distally, slightly bilobed. *Mandibles* (Fig. 8E, F) incisor well developed, with blunt denticles; spine row (Fig. 8F1) with 3 spiniform setae. Mandibular body with several setules. Molar reduced. Palp with 3 articles, article 2 and 3 subequal, naked. Article 3 without A3-seta, with 2 terminal E3 setae. Left mandible *lacinia mobilis* broad, with blunt denticles. Right mandible *lacinia mobilis* absent. *Lower lip* (Fig. 8G) inner lobes not visible, outer lobes small and sparsely setose, mandibular lobes blunt and rounded. *Maxilla 1* (Fig 8H) inner plate with 1 distal seta, outer plate with 2 denticulate, 3 bifurcate and 2 simple spiniform apical setae arranged in a pseudocrown (Fig. 8H1) and with several setules. Palp uniarticulate, with 2 terminal setae. *Maxilla 2* (Fig. 8I) plates feeble. Inner plate with 3 simple setae. Outer plate with 3 pinnate setae and outer setules. *Maxilliped* (Fig. 8J) inner plates, small, narrow, just reaching the base of palp article 1 rectangular, apically with 2 spiniform and 1 simple setae. Outer plates subovate, short, reaching just beyond palp article 1, medially and distally with few simple and spiniform setae but without denticles, lateral margin naked. Palp articles wide but not elongated, articles 2-3 medially with scattered setae, lateral margin naked, article 3 medially with blunt bifurcated setae, article 4 claw-like.

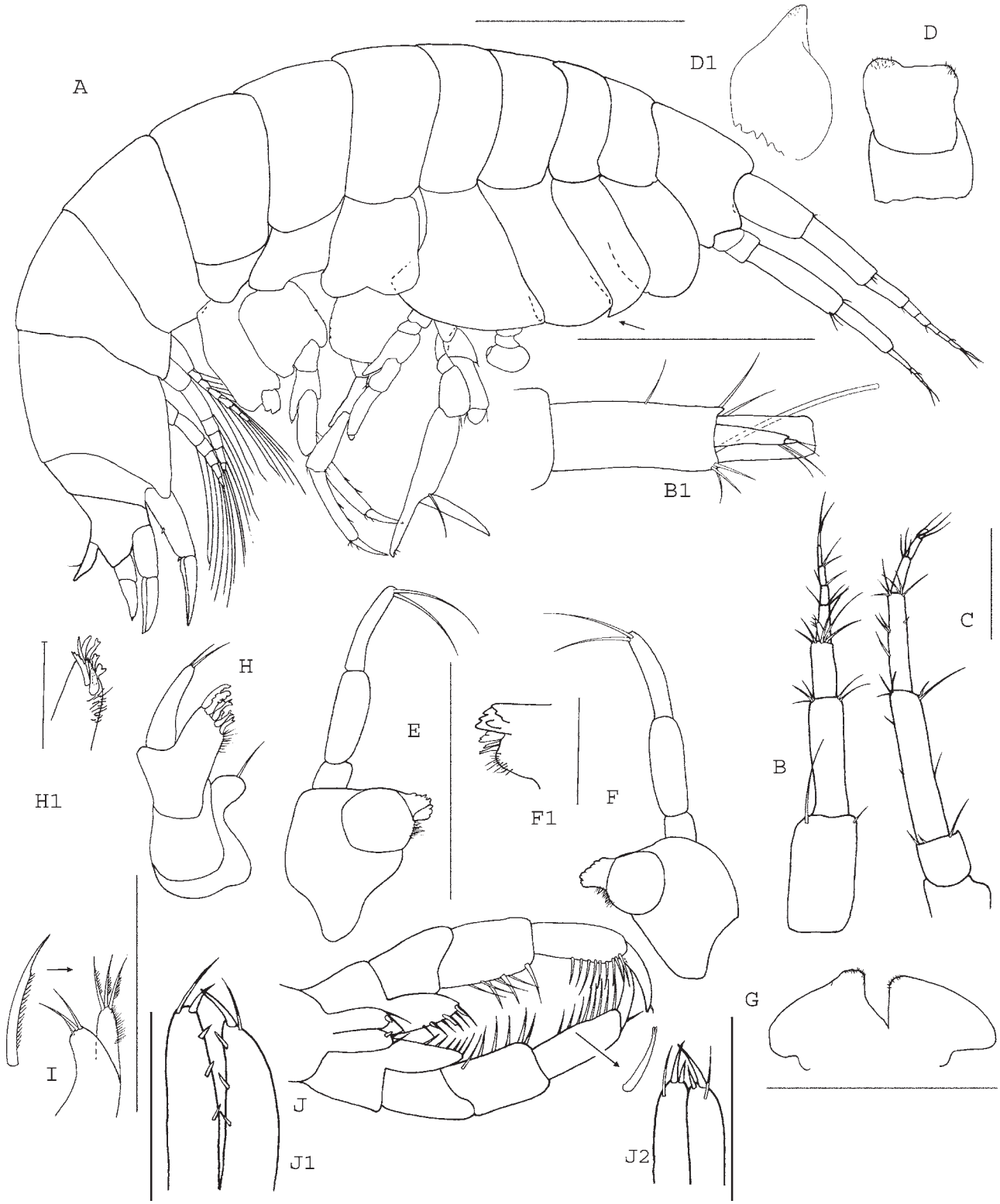

FIGURE 8. *Seba bathybia* n. sp. A, holotype, male, 2.8 mm (FMNH #13758), habitus, lateral view (not straightened), Scale bar 0.5 mm. B-J paratype male, 3.4 mm (FMNH # 12771). B, antenna 1; B1, accessory flagellum; C, antenna 2; D, upper lip, dorsal view; D1, same, lateral view; E, left mandible; F, right mandible; F1, left mandible incisor, *lacinia mobilis,* spine row; G, lower lip; H, left maxilla 1; H1, right maxilla 1 outer plate spiniform setae; I, maxilla 2; J, maxilliped; J1, same, outer endite; J2, same, inner endite.. Scale bars F1, H1, J1 & J2 = 0.1 mm, other scale bars = 0.2 mm.

Gnathopod 1 (Figs. 10A, 10A1, 11A). Subchelate, but tending to chelate. Basis slender, 4 times as long as ischium and naked except for 1 large subdistal and 1 small distal setae. Ischium naked, as long as merus.

Merus naked, marginally shorter than carpus. Carpus ventrally lobate, 0.3 times as long as propodus, with several ventral pinnate setae. Propodus rectangular, slightly widening distally (Fig. 10A1) inclusive of palm 0.85 times as long as basis, ventral margin with many pinnate setae. Palm bent ventrally, relatively smooth, with evenly spaced inner setae. Dactylus proximally with dorsal seta and fitting palm.

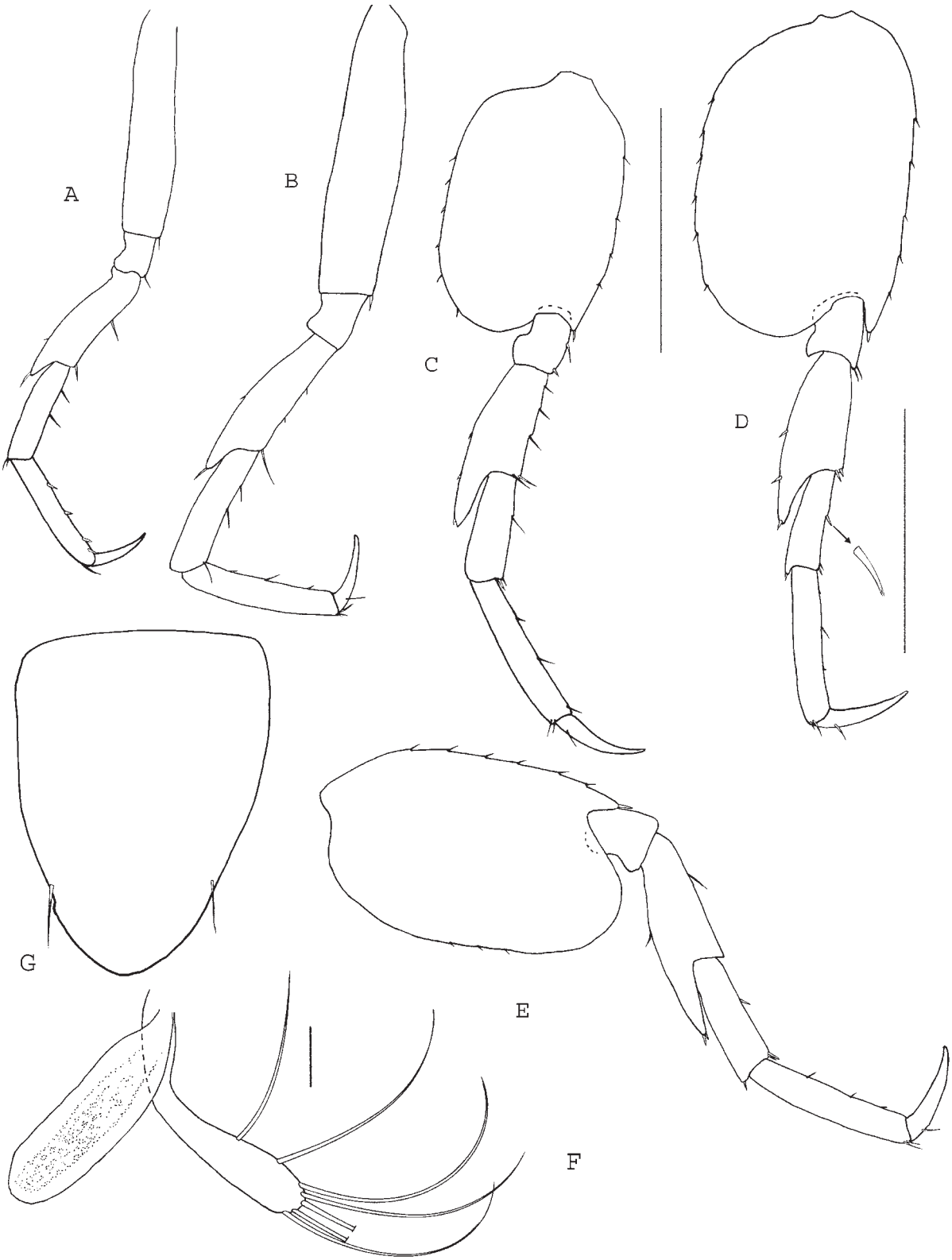

FIGURE 9. *Seba bathybia* n. sp. Paratype male, 3.4 mm (FMNH # 12771). A, pereopod 3; B, pereopod 4; C, pereopod 5; D, pereopod 6; E, pereopod 7; F, oostegites and gill; G, telson. Scale bar F & detail = 0.1 mm other scale bar 0.2 mm.

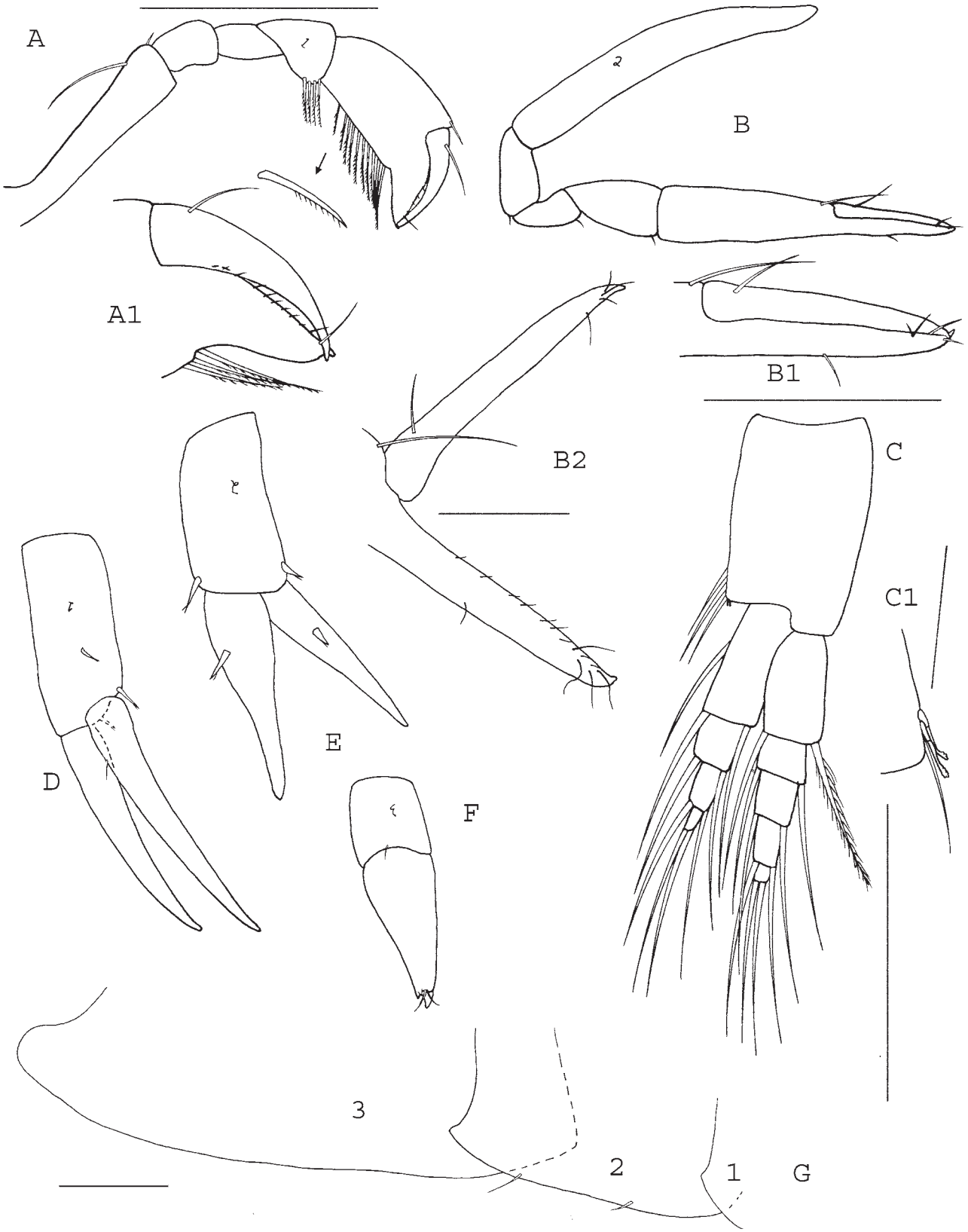

FIGURE 10. *Seba bathybia* n. sp. Paratype male, 3.4 mm and female 3.7 mm (FMNH # 12771). A, gnathopod 1; A1, same, chela; B, gnathopod 2; B1, same chela; B2, same, female, chela; C, pleopod 1; C1, same, retinaculae; D, uropod 1; E, uropod 2; F, uropod 3; G, epimeron 1-3. Scale bar B1, B2, C1 & H 0.1 mm, other scale bars 0.2 mm.

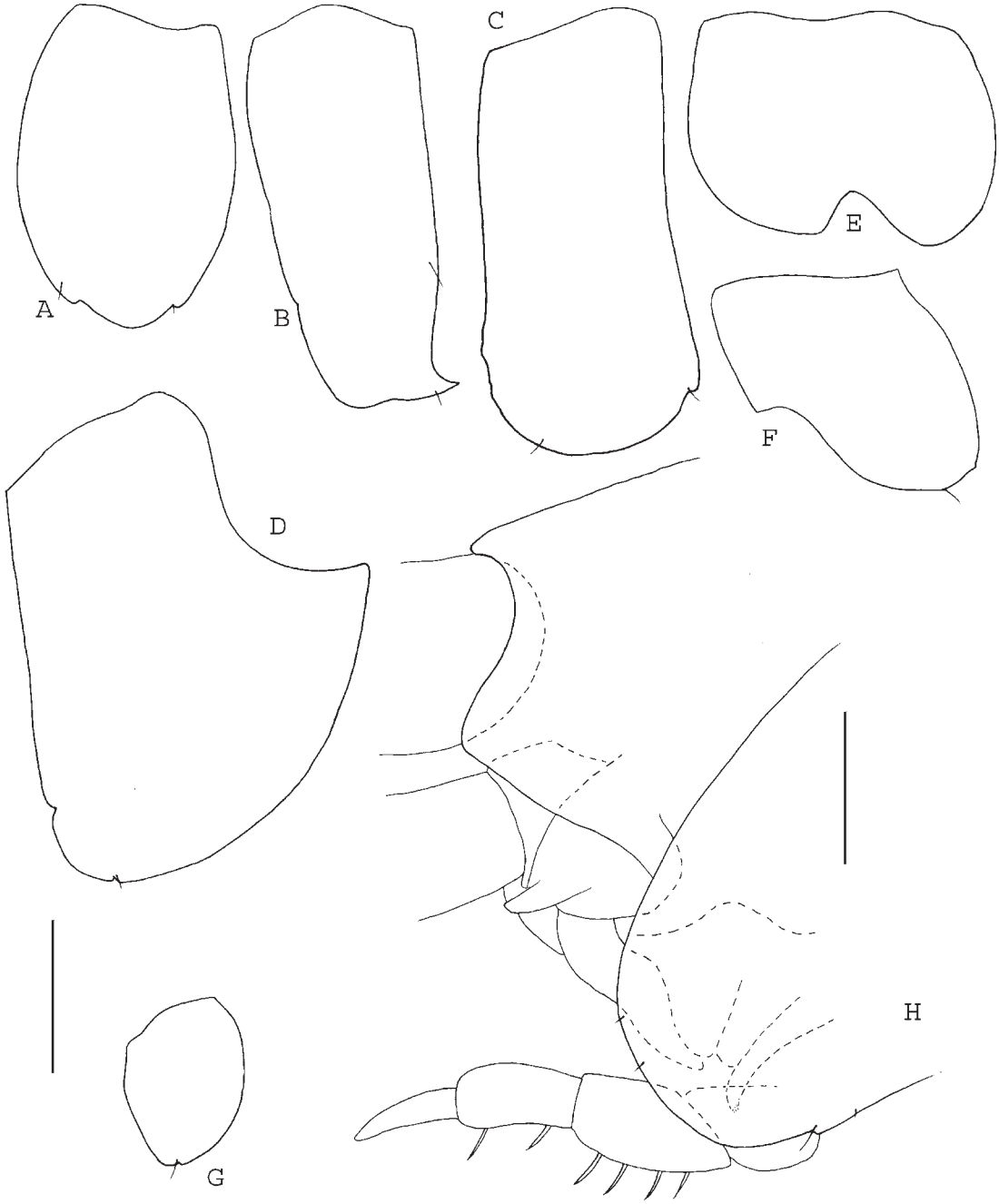

FIGURE 11. *Seba bathybia* n. sp. Paratype male, 3.4 mm (FMNH # 12771). A, gnathopod 1 coxa; B, gnathopod 2 coxa; C, pereopod 3 coxa; D, pereopod 4 coxa; E, pereopod 5 coxa; F, pereopod 6 coxa; G, pereopod 7 coxa; H, head and mouthparts. Scale bar coxa = 0.2 mm, scale bar head = 0.1 mm.

Gnathopod 2 (Figs. 10B, 10B1, 11B). Chelate. Basis naked, marginally longer than propodus (inclusive palm). Ischium marginally longer than merus, with 1 ventrodistal seta. Merus 0.2 times as long as basis, with 1 ventrodistal seta. Carpus longer than ischium, widening distally with 1 ventral seta. Propodus slender, narrowing distally (Fig. 8B1) more than 3 times as long as carpus, with 1 dorsodistal seta. Lower finger of chela, straight, slender, and with only 1 ventral seta and 4 setae on palmar edge. Dactylus slender, straight, fitting palm, with 1 proximal dorsal seta.

Pereopods (Fig. 9A–E). Pereopod 3 (Figs. 9A, 11C) basis 5.4 times as long as ischium, with 1 small distal seta. Ischium one third as long as merus, with 1 small distal seta. Merus 1.2 times as long as carpus, with anterodorsal extension, with few scattered setae. Carpus marginally shorter than propodus, posterior margin

with few scattered setae. Propodus more than half as long as basis, with 3 short spines. Dactylus less than half as long as propodus, naked. Pereopod 4 (Figs 9B; 11D) larger than pereopod 3, but of similar appearance. Pereopods 5–7 (Figs 9C–E; 11E–G) similar, basis subovate, broadened, posterior margins very weakly serrated, posteroventral lobes not extending beyond ischium**.** Merus with strong posteroventral lobes, reaching about half length of carpus. Carpus, about 0.66 x length of propodus. Dactylus about half as long as propodus, with 1 dorsal seta.

Brood plates (Fig. 9F). Slender, with 7 long setae.

Gills (Fig. 9F). Elongated, not pleated.

Pleopods (Fig. 10C, 10C1). Fairly short and with only 4–5 articles on each ramus. Peduncle retinaculae slightly bent, blunt and articulated.

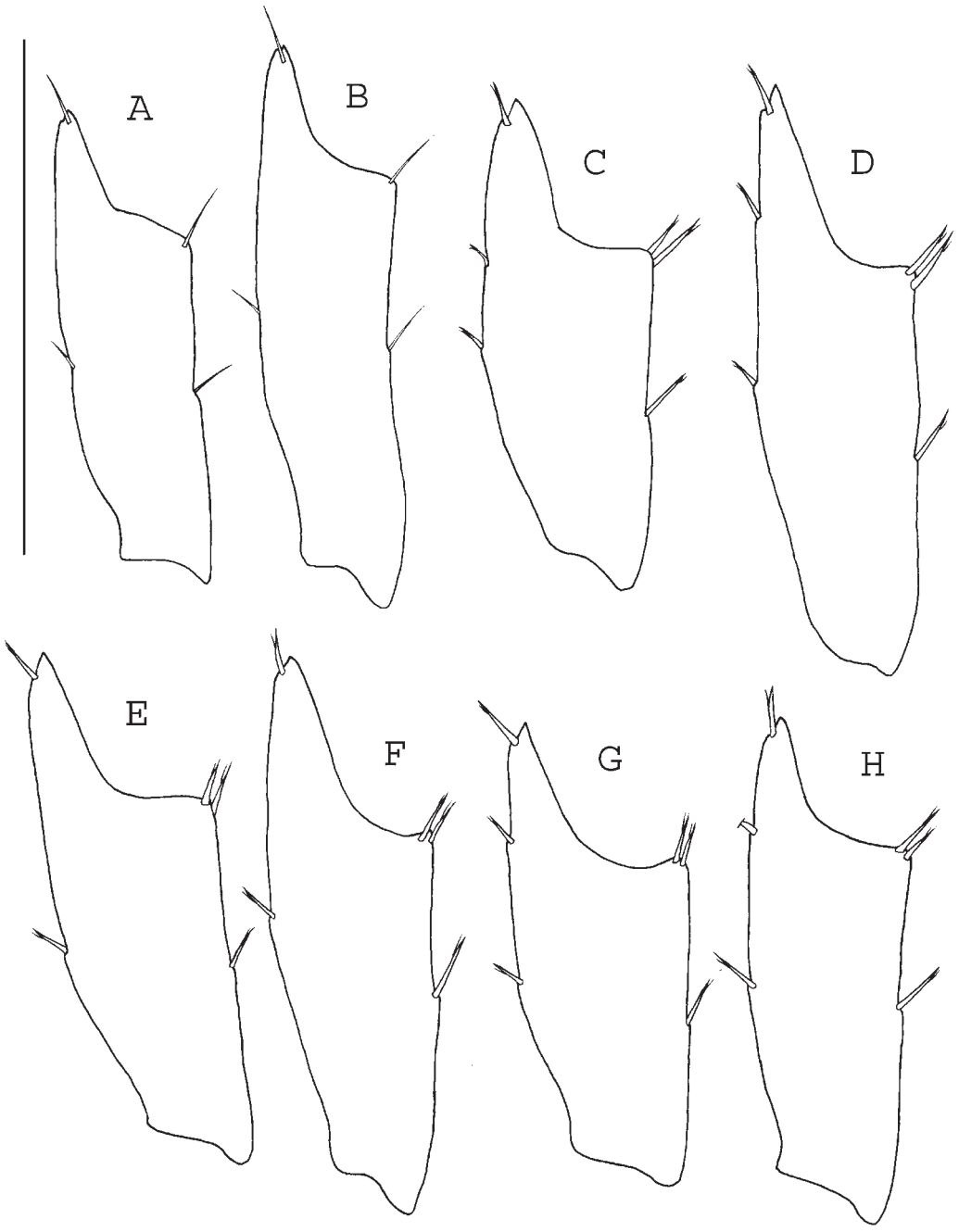

FIGURE 12. *Seba bathybia* n. sp. Paratypes male, 3.4 mm (FMNH # 12771) female, 3.3 mm (FMNH # 12771). A, pereopod 4 merus, male; B, same, female; C, pereopod 5 merus, male; D, same, female; E, pereopod 6 merus, male; F, same, female; G, pereopod 7 merus, male; H, same, female. Scale bar = 0.3 mm.

Uropods (Fig 10D–F). Uropod 1 (Fig.10D) peduncle with 2 distal and 1 medial bifurcfate spiniform setae, rami clearly longer than peduncle, outer ramus marginally longer than inner, with 1 proximal inner seta. Uropod 2 (Fig. 10E) peduncle with 2 distal bifurcate spiniform setae. Rami marginally longer than peduncle, both rami with 1 medial bifurcate spiniform seta. Uropod 3 (Fig. 10F) uniramous, peduncle with 1 simple distal seta; ramus longer than peduncle, with 2 spines and 2 setae at base of minute terminal article.

Telson (Fig. 10G). Entire, laminar, tapering distally, smoothly rounded, reaching to end of uropod 3 peduncle, with 1 distolateral seta on each margin.

Remarks. The genus *Seba* contains 14 species excluding *S. tropica* McKinney, 1980 (following the exclusion of this species from *Seba* by Shaw 1989) and the new species. Unfortunately many of these species are poorly described and often only from one sex. For these reasons a key is not created. This species is most similar to *S. profundus* Shaw, 1989 also reported from hydrothermal vents at the nearby 'Explorer Ridge' (Shaw 1989). However, it does diverge from Shaw's (1989) description in several respects. *Seba profundus* is described with a heavy denticulation on the gnathopod 1 palm inner margin and most importantly with a small notch on coxa 2 posteroventral margin and small, non-excavate coxa 4. The new species lacks the gnathopod 1 palm denticulation, has a large notch on the posteroventral margin of coxa 2 and the coxa 4 is much bigger (clearly larger than the other coxae) and strongly excavated. For these reasons the new species is erected. Shaw (1989) did not illustrate the pereopods or the entire (total) gnathopods, so it is possible that these appendages would have revealed additional characters.

According to Holman & Watling (1983) this genus is notorious for its sexually dimorphic characters and allometric variations. However, little dimorphic difference were found between the male and female of this species. The gnathopods are identical and the merus of the last 4 pereopods (Fig. 12) reveals only minor allometric variation visible in a slight elongation in the female article. The possibility remains that none of the males present are fully mature terminal males, but given the large material, this seems unlikely.

Ecology. This species is the most abundant species found in the Juan de Fuca vent field. Unfortunately, it is not known if this species is associated with other invertebrates, as typical for *Seba* (Thurston 1974; Shaw 1989). Such an association is possible since the recovered wood blocks contained a number of other invertebrates, especially wood boring clams.

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Appendix 1. Station list

FMNH sample #	Station Code	Locale	Day	Month	Year	Depth (m)	Lat. Deg.	Lat. Min.1	Long. Deg.1	Long. Min.1
12,715	VOIJALV4043B	Alvin Dive 4043, Escanaba Trough, 20 m N of Marker 6X on Central Hill	30	8	2004	3232	41	0.0272	127	29.679
12,719	VOIJALV4043B	Alvin Dive 4043, Escanaba Trough, 20 m N of Marker 6X on Central Hill	30	8	2004	3232	41	0.0272	127	29.679
12,737	VOIJALV4046I	Dive 4046; near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,738	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,748	VOIJALV4045	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,769	VOIJALV4046H	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,770	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,771	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,806	VOIJALV4043B	Alvin Dive 4043, Escanaba Trough, 20 m N of Marker 6X on Central Hill	30	8	2004	3232	41	0.0272	127	29.679
12,848	VOIJALV4046H	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,862	VOIJALV4045A	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,863	VOIJALV4045A	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,873	VOIJALV4043G	Dive 4043, Escanaba Trough, near marker 6X	30	8	2004	3226	41	0.0152	127	29.687
12,883	VOIJALV4044B	Dive 4044; Gorda Ridge, GR-14, on margin of hydrothermal vent field in basalt talus with sediment	31	8	2004	2701	42	45.258	126	42.572
12,894	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,895	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,899	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,906	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,922	VOIJALV4045	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,923	VOIJALV4045	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,930	VOIJALV4045B	Dive 4045; Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,932	VOIJALV4045B	Dive 4045; Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838

12,933	VOIJALV4045B	Dive 4045; Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
12,937	VOIJALV4044H	Dive 4044, large white biobox; Gorda Ridge, GR-14	31	8	2004	2714	42	45.244	126	42.558
12,987	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,995	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
12,997	VOIJALV4045	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
13,009	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
13,022	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
13,025	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
13,027	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478
13,034	VOIJALV4043B	Alvin Dive 4043, Escanaba Trough, 20 m N of Marker 6X on Central Hill	30	8	2004	3232	41	0.0272	127	29.679
13,040	VOIJALV4043B	Alvin Dive 4043, Escanaba Trough, 20 m N of Marker 6X on Central Hill	30	8	2004	3232	41	0.0272	127	29.679
13,042	VOIJALV4045	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
13,045	VOIJALV4045	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
13,053	VOIJALV4045A	Dive 4045, Juan de Fuca Ridge, Endeavour Segment	2	9	2004	2213	47	56.793	129	5.838
13,071	VOIJALV4043B	Alvin Dive 4043, Escanaba Trough, 20 m N of Marker 6X on Central Hill	30	8	2004	3232	41	0.0272	127	29.679
13,125	VOIJALV4046R	Dive 4046; near Wuzza Bare Mount	3	9	2004	2657	47	47.17	127	41.657
13,127	VOIJALV4046A	Dive 4046; near Wuzza Bare Mount	3	9	2004	2656	47	47.09	127	41.443
13,193	VOIJALV4046O	Dive 4046, net tow; near Wuzza Bare Mount	3	9	2004	2656	47	47.068	127	41.613
13,194	VOIJALV4046F	Dive 4046, near Wuzza Bare Mount	3	9	2004	2656	47	47.085	127	41.478

Appendix 2. Microhabitats

FMNH sample #	Habitat
12,715	on oak & fir blocks deployed 23 and 25 July 2002, on heavy sediment
12,719	on oak & fir blocks deployed 23 and 25 July 2002, on heavy sediment
12,737	sediment from under oak and fir wood blocks deployed 24 months before
12,738	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,748	on oak & fir blocks deployed 16 Sept. 2002
12,769	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,770	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,771	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,806	on oak & fir blocks deployed 23 and 25 July 2002, on heavy sediment
12,848	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,863	on oak & fir blocks deployed 16 Sept. 2002
12,873	clump of *Ridgeia*, temperature up to 19°C
12,883	sieved from water in recovery box of oak and fir wood blocks that were deployed 28 July 2002
12,894	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,895	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,899	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,906	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,922	on oak & fir blocks deployed 16 Sept. 2002
12,923	on oak & fir blocks deployed 16 Sept. 2002
12,930	sediment from under oak & fir blocks deployed 24 months before
12,932	sediment from under oak & fir blocks deployed 24 months before
12,933	sediment from under oak & fir blocks deployed 24 months before
12,937	vent margin
12,987	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,995	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
12,997	on oak & fir blocks deployed 16 Sept. 2002
13,009	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
13,022	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
13,025	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
13,027	on oak and fir wood blocks deployed 1 and 4 Sept. 2002
13,034	on oak & fir blocks deployed 23 and 25 July 2002, on heavy sediment
13,040	on oak & fir blocks deployed 23 and 25 July 2002, on heavy sediment
13,042	on oak & fir blocks deployed 16 Sept. 2002
13,045	on oak & fir blocks deployed 16 Sept. 2002
13,053	on oak & fir blocks deployed 16 Sept. 2002
13,071	on oak & fir blocks deployed 23 and 25 July 2002, on heavy sediment
13,125	sediment
13,127	sediment
13,193	near bottom
13,194	on oak and fir wood blocks deployed 1 and 4 Sept. 2002